

THE GENUS DAWSONIA.

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(Twenty-six Text-figures.)

[Read 27th April, 1949.]

INTRODUCTION.

The species of the genus *Dawsonia* form a well-marked group of mosses, and although closely resembling members of the Polytrichaceae in vegetative structure, the dorsiventral capsule with a peristome composed of a large number of hairs clearly distinguishes *Dawsonia* from any other genus. It was originally described by R. Brown in 1811 for the species *D. polytrichoides* from Eastern Australia. Since then fourteen other species have been recorded. The genus extends from Tasmania and New Zealand through Australia and New Guinea to Borneo, the Celebes and the Philippines.

As in the related Polytrichaceae, there is a conspicuous uniformity of major vegetative characters and considerable taxonomic interest has been centred on the structure of the longitudinal lamellae which occur on the upper surface of the leaf. Schleiphacke and Geheeb (1896) gave the outlines of a proposed monograph of the genus but, so far as the writer has been able to discover, this monograph was never completed. In the preliminary report they divided the genus into two sections:

Section 1.—*Polytrichoides*, in which the apical cells of the lamellae, as seen in cross section, were not differentiated from the lower cells but were only a little longer; and

Section 2.—*Superba*, in which the apical cell of the lamellae was distinctly different from the lower cells, usually the upper cell being considerably larger and more transparent.

In the present treatment these divisions have not been followed, instead, two new subdivisions are proposed: the *Longifolia* and the *Brevifolia*. The *Longifolia* section has its main centre in New Guinea but extends southwards into Australia, Tasmania, and New Zealand with *D. superba*, and northwards to the Philippines with the closely related *D. altissima*. The *Brevifolia* section has a similar distribution with the northern *D. brevifolia* in Borneo and *D. polytrichoides* and *D. longiseta* forming the southern limit in Eastern Australia and Tasmania.

DAWSONIA.

R. Brown: *Trans. Linn. Soc.*, 10: 312, 1811.

Triplocoma La Pyl. in *Desv. Jour. Bot.*, 1813, p. 7.

Robust plants, usually gregarious, covering considerable areas and forming distinct communities. Stems simple, in the sterile and male plants, normally unbranched, varying in height from a few cms. up to 70 or 80 cms. The lower part of the stem is buried in the ground and covered with white rhizoids. Above ground the stems are usually naked in their lower part, distinctly three-ribbed, shiny, dark-brown or black, with scars indicating the positions of old leaf bases. The ribs on the stems twist spirally, usually clockwise, when viewed from above. In most species the leaves are uniform and show no marked differentiation into cauline and comal leaves, but a few species have distinct scale-like cauline leaves with no lamina. The basic leaf structure is very uniform throughout the genus. The sheathing base which encloses two sides of the three-ribbed stem, the midrib corresponding to one of the stem ridges, is usually colourless or of varying shades of orange-brown with a distinct red-brown nerve. The cells of the wings of the leaf base are thin-walled, linear, about 10–12 μ broad by 80–120 μ long, with either pointed or straight end walls. At the shoulders of the leaf base the cell-walls are very conspicuously thickened and the cell-cavities become small and

lenticular, about $8 \times 3\mu$ with their axes at right angles to the long axis of the leaf. A group of the most heavily thickened appear to form a group of motor cells which determine the angle the leaf blade makes with the stem, according to their water content. Above the sheathing base the leaf contracts abruptly to form a narrow lamina which has a central nerve and is covered on most of its upper surface by vertical lamellae. These lamellae never occupy the full width of the leaf and in all species there is a distinct border of thickened, usually reddish brown cells. In some species, owing to the lamellae being squashed somewhat flat during examination, it is often difficult to detect the border, but in others the border is obvious and in *D. longiseta* may become considerably infolded particularly at the apex and make the leaf almost cucullate. The margin bears reddish brown spinose teeth in all species. These teeth are large, usually $60-80\mu$ long and are formed from a single cell with very heavily thickened walls. Occasionally the apex of the teeth become hyaline. In older plants the teeth and margin become eroded, particularly in the smaller species, and may disappear even before the capsule is fully ripe. The lamellae are composed of a single layer of cells and vary in height from $30-100\mu$. There is a considerable variation in the structure of the lamellae in the different species. The discoid male flowers are terminal, reddish in colour and usually about 3-4 mm. in diameter. The perigonal bracts resemble very enlarged cordate leaf bases with a short point in place of the leaf blade. After flowering the stems often proliferate and plants may show evidence of many successive male flowers. Female plants are similar to the sterile, the terminal female flowers being less conspicuous than the male. At first the young capsules are erect and completely covered in a densely hairy calyptra, which is usually bright orange to red. As the capsule matures it becomes inclined and assumes its dorsiventral structure. The mature capsule is horizontal or slight hanging with the operculum obliquely set and often almost vertical. The main body of the capsule is broadly ovate, flattened or slightly concave above, convex below. When old and empty it becomes almost V-shaped in cross section. The peristome is composed of a large number of linear hairs forming a dirty white tuft which usually is very slightly twisted and contorted. New shoots may occasionally arise below the female flowers and form branched stems. Each stem usually produces only a single capsule but in most species two or more may sometimes be found arising from a single female flower.

Key to Species.

- | | | |
|-----|--|--|
| 1. | { Leaf blade more than 20 mm. long | 2 |
| | { Leaf blade less than 20 mm. long | 7 |
| 2. | { Margin of lamellae crenate in side view | 3 |
| | { Margin of lamellae plane | 4 |
| 3. | { Lamellae 5-6 cells high | <i>D. Pullei</i> |
| | { Lamellae 2-3 cells high | <i>D. papuana</i> |
| 4. | { Leaves not spirally twisted nor with falcate tips when dry | 5 |
| | { Leaves spirally twisted or with falcate tips when dry | 6 |
| 5. | { Apical cell of lamellae heavily thickened, lamellae of 3-5 rows of cells | <i>D. gigantea</i> |
| | { Apical cells of lamellae not heavily thickened, lamellae of 5-9 rows of cells .. | <i>D. superba</i> |
| 6. | { Lowest row of cells of lamellae quadrate or hexagonal | <i>D. altissima</i> |
| | { At least some of lowest row of cells rhomboidal | <i>D. grandis</i> |
| 7. | { Stems less than 5 cm. high | 13 |
| | { Stems more than 5 cm. high | 8 |
| 8. | { Leaves somewhat falcate, distinctly crisped when dry | <i>D. crispifolia</i> |
| | { Leaves not falcate, hardly crisped when dry | 9 |
| 9. | { Leaves distinctly appressed when dry | 10 |
| | { Leaves not strongly appressed when dry | 11 |
| 10. | { Leaves linear, narrow, 7-9 mm. long | <i>D. limbata</i> |
| | { Leaves narrow triangular, 9-15 mm. long | <i>D. Beccarii</i> |
| 11. | { Stem with distinct scale-like leaves in the lower part | <i>D. brevifolia</i> |
| | { Stem without distinct scale leaves | 12 |
| 12. | { Lamellae of 5-9 rows of cells | <i>D. intermedia</i> |
| | { Lamellae of 4-5 rows of cells | <i>D. polytrichoides</i> |
| 13. | { Leaves lingulate obtuse or almost obtuse | <i>D. longiseta</i> |
| | { Leaves linear lanceolate acute | <i>D. polytrichoides</i> var. <i>minor</i> |

LONGIFOLIA.

Plants tall 20-60 cms., lower part of the stems naked and shiny, leaves long 20-35 mm., linear or narrow linear-lanceolate, very acute. Capsule robust, usually 1 cm. or more long.

1. *Dawsonia Papuana* F.v.M., ex Schlie. et Geh.

Rev. Bryol., 23: 76, 1896. Schliephacke et Geheeb.

Stems tall, more than 20 cms. high, the lower part naked, the upper 15-20 cms. clothed with leaves. Leaves, when moist, flat and standing almost at right angles to the stem, when dry, twisted along their axis, flexuose, the tips usually somewhat falcate and the margins only slightly inrolled except at the tip. Leaf base sheathing, reddish brown 2-3 mm. long by 1.5-2 mm. broad, with a distinct nerve. Leaf blade narrow linear lanceolate, tapering to an acute toothed apex, 25-30 mm. long. Margin toothed almost to the base. Apex of the leaf thickly set both back and front with numerous teeth 80μ long. Lamellae about 80 in number, not quite touching each other, $30-35\mu$ high, usually of three rows of cells, occasionally only two, the apical cell only slightly differentiated from the lower and a little larger. Margin slightly crenulate from the curved upper walls of the apical cells. In side view apical cells usually elongated at right angles to the long axis of the leaf, measuring $12\mu \times 8\mu$ but occasionally square. Cells of the central row fairly regularly hexagonal about 8μ across. Male plants not known. Seta long, 3.5 cm., yellowish below, reddish above, capsule 1 cm., horizontal to almost pendant, light brown. Operculum somewhat attenuated 6 mm. long.

The above description is based on material from the type gathering now in the Melbourne Herbarium and the Natural History Museum, South Kensington. Text-figures 1 and 14 were drawn from material now in the Natural History Museum Collection.

The original gathering was made by McGregor at 4,900 feet about 48 miles N.E. of Kikori near the Hather Gorge on the Upper Purari River, Mount Musgrave, New Guinea, on 25th June, 1889. Portions were distributed by Mueller as *D. Papuana* n. sp., Geheeb being one of the recipients. It has not been possible to find any trace of a description having been published by Mueller and it would appear that the first published description is that given by Schliephacke and Geheeb in 1896. The same species was again gathered by McGregor in 1890 from Mt. Yule and in 1891 from Mt. Suckling, New Guinea.

The species appears to be closely allied to *D. superba* and *D. altissima*. It is, however, readily separated from the former by the lamellae, being no more than three cells high, whereas in *D. superba* they are rarely less than five cells high and by the difference in the marginal cells of the lamellae. From *D. altissima* it can be distinguished by the apical cells in side view being taller than they are wide, and in the crenulate margin of the lamellae. In dried material the flexuose, twisted, flatter leaf blades readily distinguish *D. Papuana* from the straight more inrolled and more appressed leaves of *D. superba*.

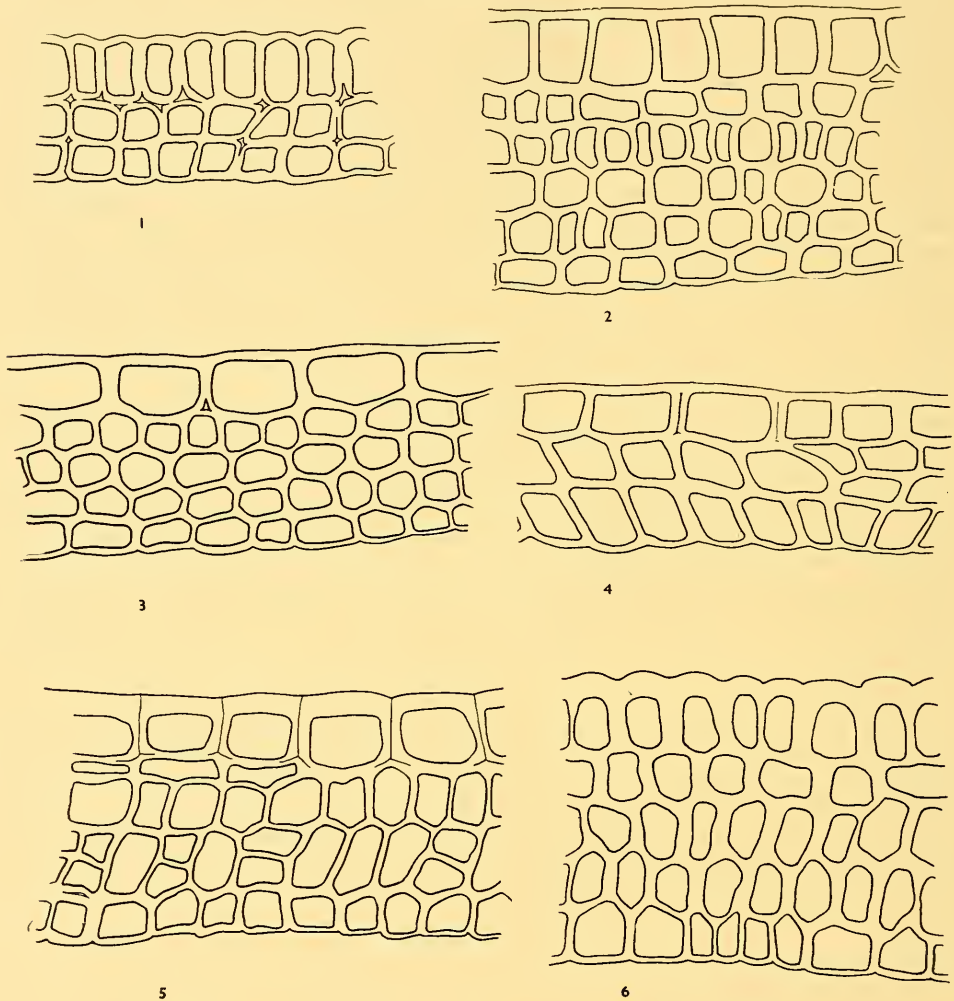
2. *Dawsonia superba* Grev.

Greville, *Ann. Nat. Hist.*, 19: 226, 1847.

D. longifolia Brown m.s.

Stems tall 20-70 cms., usually about 30-40 cms., unbranched except the female plants, which may sometimes produce one or more lateral shoots below an inflorescence. In the field the stems are straight but often show a tendency to be flexuose when dried. Lower part of stem naked, shiny, dark brown to black, in places light brown due to persistent leaf bases. Upper 15 cms. of stem leafy, leaves when dry, straight and almost vertical although not markedly appressed to the stem. Leaf margin inrolled from immediately above the sheathing leaf base so that the leaf blade appears very narrow and tapering and only very occasionally shows any tendency to be twisted or flexuose. When moist, leaf blade flat, standing at right angles to the stem or slightly reflexed. Leaf base sheathing, orange-red becoming light brown when old; up to 4 mm. long, 1.5 mm. wide at the base, 3 mm. wide at the shoulder with a distinct central nerve.

Leaf base suddenly narrowed to the long linear blade. Leaf blade 20–24 mm. long, slightly less than 1 mm. wide, remaining more or less constant in width for about two-thirds of its length and then tapering to a fine point. Margin strongly toothed throughout. Apex toothed at both back and front for about 5 mm., teeth at the back of the nerve usually in pairs or in threes. Lamellae about 60 in number, 60–80 μ high usually of about six rows of cells but the number is variable and may be as many as nine or occasionally as few as four. Margin almost straight. Apical cells distinct from



Text-figures 1-6.—Detail of lamellae shown in side view.

1. *Dawsonia Papuana*. 2. *D. superba*. 3. *D. altissima*. 4. *D. grandis*. 5. *D. gigantea*.
6. *D. Pullei*. All $\times 220$.

the lower cells of the lamellae, usually colourless and almost square, 14 μ across, very variable in their degree of thickening. At times the apical cell wall hardly differs from that of the lower cells; at others the apical cell walls are heavily thickened. A similar variation is seen in sectional view; the apical may be much wider than the lower cells and be almost obovate or may be very little wider and almost rectangular and subquadrate, about 10 μ in diameter. Female plants similar to the sterile plants, perichaetial leaves hardly differing from the foliage leaves. Seta usually short and somewhat flexuose, the capsule usually not exceeding the comal leaves in the dry condition. This,

however, appears to be a variable character and although average measurements for the seta are 10–15 mm. by 0.5 mm., some New Zealand specimens have the setae up to 3.5 cms. long by 1 mm. thick. Calyptra large, up to 1 cm., densely covered with silky red or orange hairs. Capsule flattened, borne at right angles to the seta, concave above, convex below, 7×4 mm. Peristome a dense tuft of pale brown or dirty white hairs 3 mm. long. The orientation of the capsule is very variable owing to the manner in which the seta curves when dry.

Type not seen. Text-figures 2 and 15 drawn from material collected from Dorrigo, N.S.W.

This species is widespread and abundant throughout Eastern Australia, Tasmania and New Zealand, where it is usually found in rain forests or wet sclerophyll forest. Dixon (1922) includes *D. superba* for New Guinea. I know of no certain record from New Guinea. The material collected by Brass and assigned by Bartram to *D. superba* is *D. Pullei* (see p. 91). There is, however, a sheet in the Melbourne Herbarium simply labelled "New Guinea" with no collector, locality, or date. This specimen is *D. superba* but approaches much nearer to *D. altissima* than any Australian or New Zealand material I have seen. Bartram (1939) refers the Philippine species to *D. superba*. The identity of these Philippine plants is discussed on page 89 and reasons are given there for regarding them as *D. altissima* Geh. For the present, the writer regards *D. superba* as a plant confined to Eastern Australia, Tasmania and New Zealand, and considers the closely related plant found in Borneo, the Celebes and the Philippines as *D. altissima*.

3. *Dawsonia altissima* Geh.

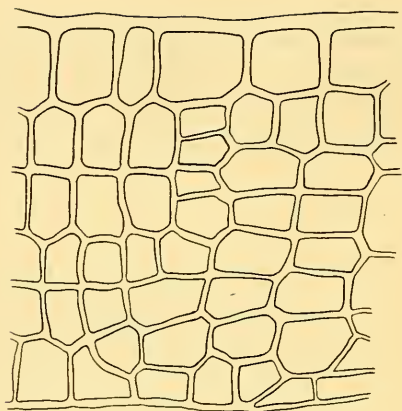
Geheeb, *Flora*, 69: 352, 1886.

Stems up to 50–60 cms., unbranched, the upper 20–30 cms. leafy, lower part denuded of leaves, triangular, shiny dark brown, three ribbed. Leaves when moist straight and flat, standing almost at right angles to the stem. When dry crisped and twisted often markedly so. Leaf base sheathing orange brown, with distinct mid-rib 3×2.5 mm. Leaf blade linear, tapering in the upper third to a sharply toothed apex, 30–35 mm. long. Margin toothed to within a short distance of the base. Apex very strongly toothed both back and front, teeth at the apex up to 250μ long. Lamellae about 60μ , not quite touching each other, 35μ to 45μ high of 4–5 cells. Lower cells fairly regular, usually subquadrate $6\text{--}8\mu$ across, apical row very distinct, usually without chlorophyll and much wider than high, about $10\mu \times 16\mu$. Margin of lamellae almost straight, each individual apical cell often corresponding fairly distinctly with two cells in the layer below. Seta variable in length 2–3.5 cms. by 0.5–1 mm., usually slender, slightly curved or very slightly arcuate when dry. Capsule large, 9×5 mm. Dixon (1934) records that the specimens from the Celebes were characterized by having a very short stout seta, but otherwise did not seem to differ from the Borneo plant.

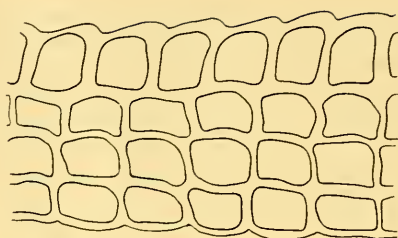
The material collected by Burbidge on Mt. Kinabulu, Borneo, 1877–78, part of which is now in Kew Herbarium, would appear to be the type material. Text-figures 3 and 16 and the above description are based on this material.

Apparently not uncommon in the higher mountains of Borneo, the Philippines, and the Celebes.

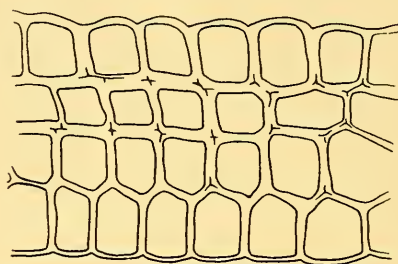
There appears to have been considerable confusion regarding this species. When it was first received by Geheeb, he regarded it as merely a robust form of *D. superba*. Subsequently, however, he considered it to be sufficiently distinct and named it *D. altissima*. The differences which separate it are admittedly slight and somewhat difficult to define, nevertheless they were regarded as sufficient to warrant its retention as a separate species, by Gepp (1913) and Dixon (1922). Confusion is only likely to arise with *D. superba*. In typical specimens the difficulty is not very great. *D. altissima* is a taller plant with longer leaves which always show some twisting along their axis. In dried material the leaf blade is always flatter than in *D. superba* and the leaves are less erect. In *D. superba* the leaves are usually straight and, when dry, the leaf margin becomes inrolled from immediately above the sheathing base making the leaf very narrowly triangular. Differences also exist in the appearance of the apical cells of the



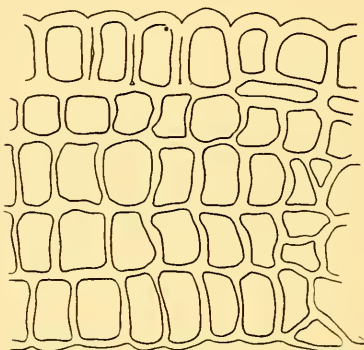
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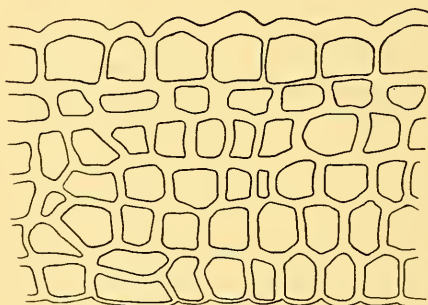
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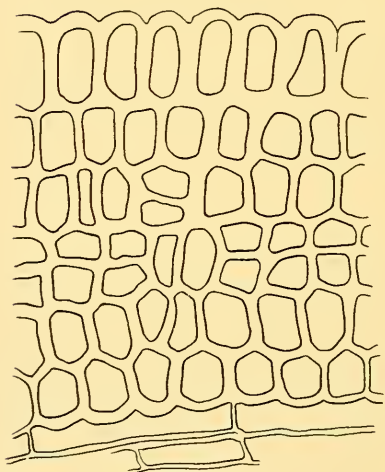
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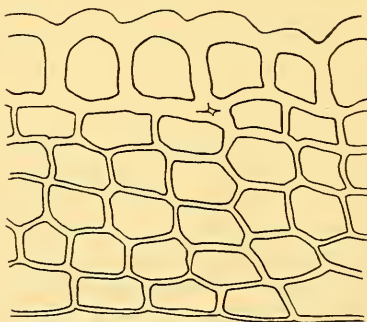
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11



12



13

Text-figures 7-13.—Detail of lamellae shown in side view.

7. *Dawsonia intermedia*. 8. *D. polytrichoides*. 9. *D. brevifolia*. 10. *D. Beccarii*.
11. *D. limbata*. 12. *D. crispifolia*. 13. *D. longiseta*. All $\times 220$.

lamellae when seen in side view. This difference is difficult to define but seems to be due to the way in which the thickening is laid down. In *D. superba* the vertical walls between the apical cells appear as if made of a single layer which may vary greatly in thickness; in *D. altissima* the thickened wall seems to consist of two distinct layers. In most specimens of *D. superba* the apical cells are approximately square in side view and those of *D. altissima* are about twice as long as they are high, but this difference is of less value than the others given above. In the collections examined there has been little trouble in placing material from Borneo and the Celebes as *D. altissima*. The material from the Philippines has, however, proved much more difficult and approached much more closely to *D. superba* as it occurs in Australia than did the specimens from Borneo or Celebes. The Philippine material has previously been regarded as *D. superba*, first by Brotherus and subsequently by Bartram (1939). It is possible that Brotherus, when he identified the Philippine material, did not fully understand *D. altissima* as when Pflanzenfamilien, Ed. I was written he had not seen *D. altissima*. The Philippine specimens examined by me were:

- (1) Collected by Elmer, Mt. Apo, 1909, identified by Brotherus as *D. superba*.
- (2) Collected by Hachisuko, Mt. Apo, 1921.
- (3) Collected by Mearns and Hutchinson, Mindanao, identified by Brotherus as *D. superba*.

In this material the twisting of the leaves, while never so distinct as in material from Borneo, was, however, quite apparent. Most of the leaves, when dry, lacked the typical inrolled margins and straight triangular outline of typical *D. superba*. Examination of the lamellae showed them to be very variable both in shape of the apical cell and in the height of the lamellae. Nevertheless all the preparations showed the characteristic thickening of *D. altissima*. Taking all the characters together, I feel that the Philippine plants are best placed as *D. altissima*.

Whether *D. altissima* is worthy of full specific rank must be reconsidered at a later date. When a wider range of material is available it may be found that several of the large species such as *D. altissima* and *D. papuana* should be regarded as geographical subspecies of *D. superba*, but in view of the lack of material and scanty state of our knowledge regarding the moss flora of the area between Australia and the Philippines, I do not think it wise to lump at present and have therefore retained *D. altissima* as distinct.

4. *Dawsonia grandis* Schliep. and Geh.

Schliephacke and Geheeb, *Rev. Bryol.* 23: 88, 1896.

Stems simple, tall, 40 or more cms. high, the upper 20-30 cms. leafy; the lower part of the stem triangular, denuded of leaves or with the torn remains of the sheathing leaf bases, shiny dark brown to black, with scars of the old leaves. Leaves, when moist, straight or with their tips slightly curved, standing at right angles to the stem; when dry, usually somewhat twisted, the leaf blade about 45° to the stem. In material which has been heavily pressed, the leaves tend to be rather straight with the apices of the leaves, particularly the upper ones very regularly and noticeably falcately hooked. In material which has dried without being heavily pressed, the regular falcate curving of the leaf apices is less noticeable owing to the general crisping of the leaves. Leaf base 4 × 2.5 mm. orange-brown; leaf lamina 3-4 cm. long, 1-1.5 mm. broad, linear, upper third tapering to a point. Apex toothed back and front, margin toothed almost to the base. Lamellae about 120, 20-30μ high. Margin of the lamellae straight, apical cells not very different from the lower cells, approximately 12 × 12μ, sometimes a little wider than high. Cells of the lowest layer somewhat variable with many cells distinctly rhomboidal. Capsules usually borne singly but not infrequently two capsules occur on a single stem. Seta stout, rigid, usually about 3 cms. long by 1-2 mm. thick, brownish, often showing distinct ribs when dried. Capsule large, 12 × 8 mm. broadly oval, compressed, about 3 mm. thick, slightly concave above, convex below horizontal to somewhat downward pointing; when old, often becoming V-shaped in cross section. Peristome dirty white up to 5 mm. long.

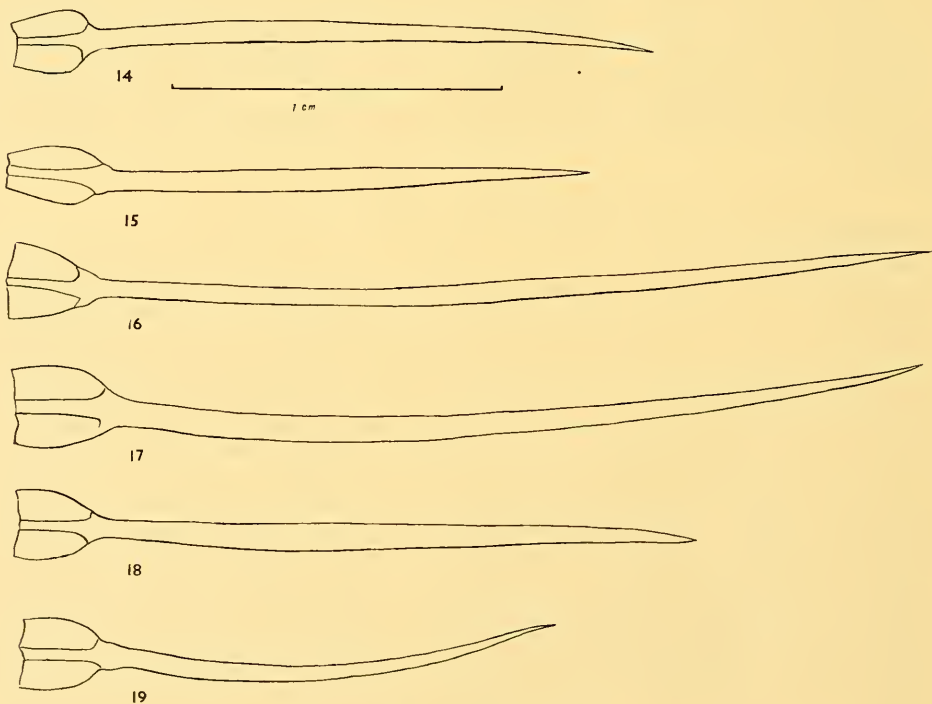
Type material was collected by W. Armit, Mt. Musgrave, New Guinea, June, 1894. This was distributed by F. v. Mueller as *D. papuana*; Geheeb, when he received it, recognized it as distinct, and described it as *D. grandis*. Figures 4 and 17 and the description were made from part of the original material.

D. grandis is apparently restricted to New Guinea, where it is probably the commonest species. The stout rigid seta and the rhomboidal cells of the lower row in the lamellae readily distinguish this species from all others. In some lamellae the bulk of the lower cells may appear regular, but groups of rhomboidal cells are always present.

5. *Dawsonia gigantea* C.M.

C. Mueller, *Hedw.*, 36: 336, 1897.

Stems simple up to 50 cms. high, upper 10-20 cms. leafy, the lower part denuded of leaves or covered with the remains of tattered leaf bases. Leaf base 3.5 × 3 mm. orange with distinct central nerve. Leaf blade about 25 mm. long, 1-1.25 mm. wide, very narrowly lanceolate, slightly contracted immediately above the sheath. When dry, leaves show a slight tendency to be crisped, the leaf blade, however, tends to remain flatter and the margins are less incurved than in some of the other species. Margin toothed to within about 3-4 mm. of the base, apex strongly toothed, nerve toothed at the back near the apex. Lamellae about 90 in number, approximately 50 μ high usually of four, occasionally of three or five rows of cells. Apical cell very distinct both in side view and in section. In side view 16 μ high, 20-25 μ wide, walls considerably thickened, outer wall 4-6 μ thick. Lower rows of cells, subquadrate, thin-walled about 10 μ across. Capsule on a relatively stout seta, 10-15 mm. long by 1-2 mm. thick. Capsule large, 10 × 7 mm., horizontal; operculum 5 mm. long. Peristome dirty yellowish-white, 3 mm., slightly twisted.



Text-figures 14-19.—Leaf outline.

14. *Dawsonia Papuana*. 15. *D. superba*. 16. *D. altissima*. 17. *D. grandis*.
18. *D. gigantea*. 19. *D. Pullei*.

Type not seen. Collected by Beccari, July, 1875, from Mt. Arfak, New Guinea, apparently as No. 160 in Geheeb's collection. Material from which the above description and Text-figures 5 and 18 were drawn was collected by Gibb (No. 5523), Mt. Arfak, December, 1913.

A very distinct species readily distinguished by the thickened apical cells of the lamellae. Apparently restricted to New Guinea.

6. *Dawsonia Pullei* Fleischer.

Stems tall, up to 50 cms., upper 15–30 cms. leafy, lower part naked or covered with torn leaf bases. Leaves, when dry, strongly crisped, the upper third of the leaf often tightly coiled, leaf margins not inflexed, except near the apex. Lower leaves 15 mm. long, upper leaves up to 30 mm. Lamellae about 80 in number, 50–70 μ high usually of 4–5 rows of cells, margin crenulate, apical cells in side view 15 μ high by 9 μ wide, occasionally almost square. Walls of the apical cells very heavily thickened, particularly on the outer wall. Lower cells variable, quadrate, rectangular to rounded hexagonal. Seta 3–5 cms. by 2 mm. wide, dull orange-red above, later becoming dark brown or black. Capsule large, 12–13 mm. by 5 mm., horizontal when maturing, operculum up to 6 mm.; calyptra covered with hairs, reddish orange. Peristome dirty white, 2–3 mm. long.

Type material collected by A. Pulle on Mont Hellwig, alt. 1,800 M., No. 727, 17th December, 1912, on the Third Dutch Expedition to New Guinea. Material of this species was distributed as *D. Pullei* n. sp. Fleischer. So far I have been unable to find any published description of this species. What is clearly the same species was collected by L. J. Brass (No. 10554) at Lake Habbema, New Guinea, in October, 1938. This material was recorded by Bartram (1942) as a form of *D. superba*. The above description and figures 6 and 19 have been drawn from the part of the original collection now in Kew Herbarium.

D. Pullei is by far the most distinct of the large *Dawsonias*; the tight spiral coiling of the leaves and the characteristic lamellae readily separate it from the other species. It is known only from the two New Guinea collections.

BREVIFOLIA.

Plants 10–25 cms. high, leaves usually under 15 mm. long, narrow linear or narrow linear triangular, very acute, seta slender, capsule usually 4–8 mm. long.

The species of this section fall naturally into three groups. *D. polytrichoides* and *D. intermedia* from Australia, which form the first group, suggest small specimens of the longifolia. The New Guinea species *D. Beccarii*, *D. crispifolia* and *D. limbata*, with their narrow, almost subulate leaf blade, are clearly closely allied to each other. The Borneo and Celebes, *D. brevifolia*, as might be expected from its distribution, stands somewhat apart from the others.

7. *Dawsonia intermedia* C.M.

C. Mueller, *Hedw.*, 1897, 335.

Stems simple, variable in height from 10–30 cm., lower part of stems bare, triangular, blackish, upper 6–10 cm. leafy. Leaves uniform, when moist, standing at right angles to the stem; when dry, making an angle of about 45° with the stem. Sheathing leaf base 3 × 2 mm. colourless or orange with an orange-brown central nerve. Lamina narrow linear lanceolate, about 10–15 mm. long by 1 mm. broad, margin strongly toothed. Apex with several closely set teeth, often reddish. Margin inrolled, when dry, making the leaf almost terete. Lamellae 50–60 in number, about 100 μ high, of 5–9 rows of cells. Margin of lamellae almost straight, marginal row of cells differentiated from the lower cells variable in size and shape, usually rectangular, 16 × 24 μ with long axis either at right angles or parallel to the leaf axis, thick outer wall usually with a granular appearance. Lower cells quadrate or polygonal, 10 μ across. Perichaetial leaves grading into the cauline, innermost with few lamellae, the lamina being reduced to a toothed subula at the end of a large sheathing base. Seta 15 mm. × 0.75 mm., when dry somewhat flexuose and twisted, ribbed with 5–8 ribs in the upper part. Capsule ovate 8 × 6 mm. Peristome 2 mm. long, dirty white, slightly twisted.

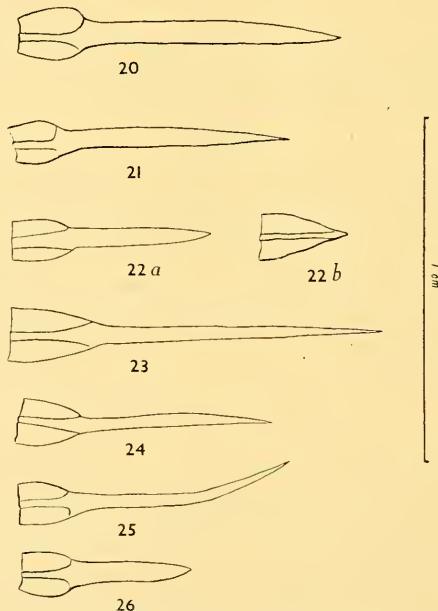
Above description and Text-figures 7 and 20 are based on material collected by Luehmann, 1881, Upper Yarra, Victoria, originally in Herb. Bescherelle, now in Natural History Museum collection. Luehmann's gathering apparently forms the type material.

Not uncommon in eastern New South Wales and Victoria, and probably also occurs in Queensland. It appears to be a rain forest species and is fairly distinct. Although resembling *D. polytrichoides* in the field, it can readily be separated on the size of the lamellae.

8. *Dawsonia polytrichoides* R. Br.

R. Brown, *Trans. Linn. Soc.*, 10: 316, 1811.

Stems simple, 5-20 cm., mostly about 10 cm., lower part of stem usually brownish with the remains of the old leaf bases, triangular. Leaves, when dry, somewhat loosely appressed but not markedly so. Sheathing base, 2×1.5 mm., pale or orange with orange-brown central nerve. Lamina narrow linear lanceolate, 6-10 mm. \times 0.75 mm., margin and apex strongly toothed, nerve toothed at back above. When dry, leaf margin inrolled making the leaves almost terete. Lamellae about 60 in number, 50μ high, of 4 or 5 rows of cells. Margin of lamellae distinctly crenate from the projecting margin cells. Marginal cells distinct, thickened, outer wall often granular, about $10 \times 12\mu$ elongated in either direction. Lower cells $10 \times 8\mu$ usually elongated parallel to the axis of the leaf but sometimes almost quadrate or hexagonal. Perichaetial leaves consist of a spiny flexuose subula and a greatly lengthened sheathing base. Seta about 2.5 cm. \times 0.5 mm., orange-red when young, dark brown when old. Capsule ovate 5 \times 3 mm. Calyptra large, 1.5 cm. \times 5 mm. densely set with crimson hairs. Peristome dirty white.



Text-figures 20-26.—Leaf outline.

20. *Dawsonia intermedia*. 21. *D. polytrichoides*. 22. *D. brevifolia*. 23. *D. Beccarii*.
24. *D. limbata*. 25. *D. crispifolia*. 26. *D. longiseta*.

Above description and Text-figures 8 and 21 are based on material collected from National Park, N.S.W., by the writer. The material in the Herbarium, Kew, collected by R. Brown, "Australia", probably is the type. Examination of this material shows it to agree well with numerous collections from New South Wales and Queensland.

Var. *minor* C.M., ? in lit. only.

Stems 2-4 cm., lower 1-2 cm. naked. Leaves when dry usually distinctly appressed making the stems appear clavate, occasionally not very much appressed. Seta 1.5-2 cm. Differing from the type in the short clavate stems. Superficially the plants resemble *D. longiseta* in their short stems and by comparison long setas, but the structure of the leaf is typical of *D. polytrichoides*.

Whitelegge's specimen from Kangaroo Valley, 1885, would seem to be the type.

D. polytrichoides is by far the commonest species of the genus, it is widespread and abundant in Eastern Australia where it and its var. *minor* most frequently occur on freshly disturbed earth banks in sclerophyll forest. It is distributed from Tasmania to Queensland.

9. *Dawsonia brevifolia* Gepp.

Gepp, *Jour. Linn. Soc. Lond.*, 42: 209, 1914.

D. Kinabaluensis Broth. MS., in herb.

Stems mainly simple, female plants occasionally branched, 20-30 cm. tall, slender lower part of stem base naked or covered with scale leaves, upper 3-10 cm. with normal leaves. Leaves, when dry, appressed to the stems making the shoots almost cylindrical, occasionally somewhat crisped, when moist, more or less patent. Sheathing leaf base 2.5×1.75 mm., orange to brown with a central dark brown nerve. Cells of the shoulder uniformly thickened, irregular, oval $8 \times 12\mu$ without any well-marked motor cells. Leaf blade variable from 7-10 mm., occasionally up to 15 mm. in the comal tuft, narrow linear acute. The cauline leaves reduced to a triangular leaf base with an apiculus formed from the excurrent nerve, devoid of lamellae; cells of the wings of the base much laxer and more parenchymatous than of the comal leaves. Comal leaves with strongly toothed margin, somewhat inflexed. Lamellae about 70 in number, $80-100\mu$ high, usually of 6-7 rows of cells. Margin crenate with projecting cells. Marginal cells $16 \times 10\mu$ without any marked thickening, elongated at right angles to the axis of the leaf; lower cells very regularly quadrate, $10-12\mu$ across. Perichaetial leaves similar to comal leaves, slightly more strongly toothed. Seta 1.5-2.5 cm. $\times 0.75$ mm., often slightly curved. Capsule horizontal, ovate, 8×4 mm. Operculum narrow, pointed, 3 mm.

Description and Text-figures 9 and 22 are drawn from type material in Natural History Museum, collected by Gibb, 1910, Kinabalu, Borneo.

This species has been collected several times from Borneo and also from the Celebes (Dixon, 1934). Gibb collected it in 1910 and Gepp's description was published in 1914. The same species was collected by Clemens (her. No. 10549), also from Kinabalu in 1915 and provisionally named by Brotherus, *D. Kinabaluensis* n. sp. Apparently he later became aware of Gepp's description and dropped the name *D. Kinabaluensis*. The name, however, does appear in Hertzog's *Geographie der Moose*. An examination of material collected by Clemens, a sheet of which is in Kew Herbarium, shows that Brotherus' *D. Kinabaluensis* is clearly *D. brevifolia*, a very distinct species in the leaf structure. The absence of typical motor cells in the leaf base gives the plant a very distinct habit and the structure of the lamellae readily distinguishes it from any of the other species. It occurs in both Borneo and the Celebes.

10. *Dawsonia Beccarii* Broth. et Geh.

Brotherus and Geheeb, *Rev. Bryol.*, 23: 73, 1896.

Ibid., *Biblioth. Bot. Hfte.*, 44: 14, 1898.

D. altissima C.M. MS., herb.

D. filicaulis Geh. MS., herb.

Stems simple, tall, up to 40 cm., lower part of the stem bare, dark brown to blackish, triangular. Leaves straight or occasionally somewhat crisped on the lower part of the stem. When dry leaves closely appressed giving the stem a very slender appearance, when moist standing away from the stem but still more or less erect. Leaf base sheathing 3×1.5 mm., colourless to brownish, with an orange central nerve. Leaf blade very narrowly triangular varying in length from 8-15 mm. Margin strongly spinose, inflexed, apex very spinose, orange red, the lamellae ceasing some distance below the

apex. Lamellae about 40 in number, 60μ high, margin crenate due to projecting cells, usually 5–6 rows high, margin cells distinct with thickened walls, square to rectangular, $12 \times 12\text{--}20\mu$, lower cells variable quadrate or hexagonal, about $10\text{--}12\mu$ across. Some of the cells of the lowest row are often elongated parallel to the axis of the leaf and may measure $20\text{--}30\mu \times 8\mu$. Seta about 2 cm. \times 1 mm. Capsule ovate 8×5 mm., horizontal.

Type not seen, originally collected by Beccari on Mt. Arfak, New Guinea, July, 1875. The above description and Text-figures 10 and 23 are based on material collected by Gibbs (No. 5521 and 6005) from Mt. Arfak. Subsequently recorded from Lake Habbema and Mt. Wilhelmina, New Guinea.

The appressed leaves and the slender appearance make the species easily distinguishable from the others.

11. *Dawsonia limbata* Dix.

Dixon, *Jour. Linn. Soc. Lond.*, 45: 486, 1922.

Stems simple, 10–15 cm., lower 3 cm. bare, triangular dark brown. Leaves when dry straight and appressed, when moist more or less spreading. Sheathing base of leaves 3×2 mm. orange, with an orange brown central nerve. Leaf blade narrow linear 7–9 mm. \times 0.5 mm. wide. Margin spinose, incurved, often somewhat whitish, apex toothed. Lamellae about 40, 70μ high, margin crenate from projecting cells, 6–9 rows high, marginal row distinct thick-walled, $12 \times 12\mu$, lower cells quadrate or rectangular, 8μ across, walls somewhat thickened. Capsule apparently unknown.

The above description and Text-figures 11 and 24 are based on material in Herb. Dixon now in the Natural History Museum, South Kensington.

This and the two preceding species are readily separated from the remainder of the genus when dry by their uniformly appressed leaves. The leaves of *D. limbata* are shorter, more linear and less acute than those of *D. Beccarii*, which taper more or less gradually throughout their length. The species is so far known only from New Guinea.

12. *Dawsonia crispifolia* Dix.

Dixon, *Jour. Linn. Soc. Lond.*, 45: 486, 1922.

Stems simple, 15–25 cm. high, subflexuose, lower part covered with the remains of the old leaf bases, dirty brown. Leaves very characteristically crisped when dry, slightly crisped to falcate when moist. Sheathing base almost triangular, orange brown with a central reddish brown nerve. Leaf blade narrow, gradually tapering from 0.5 mm. to an acute point, somewhat falcate, 8–10 mm. long. Margin with slender slightly curved spinose teeth. Lamellae 40–50, about 80μ high, margin crenate due to the projecting cells. Lamellae mostly of 6 rows of cells, sometimes 7–8, marginal row conspicuously thickened $14 \times 6\mu$ elongated at right angles to the axis of the leaf, lower cells with thickened walls, subquadrate or subrectilinear, mostly $6 \times 10\mu$. Seta about 2 cm. \times 0.75 mm. slightly arcuate, capsule horizontal to hanging, broadly ovate, 8×6 mm., peristome large, 4 mm., dirty white.

The above description and Text-figures 12 and 25 are based on the type material collected by Kloss, Mt. Carsters, New Guinea.

Readily distinguished from all other species of the genus by its narrow falcately crisped leaves and slender almost rigid habit. Brotherus in *Pflanzenfamilien*, Ed. II, gives *D. crispata* Dix., apparently a slip, for this species. Fleischer evidently following Brotherus returned *D. crispata* for specimens collected by Lam in New Guinea, and this name thus appears in Lam's *Fragmenta Papuana* (p. 119, English translation).

D. crispifolia is so far known only from New Guinea.

13. *Dawsonia longiseta* Hpe.

Hampe, *Linn.*, 1860, 634.

Dawsonia appressa Hpe., *Linn.*, 1860, 634.

Dawsonia Victoriae C.M., *Hedw.*, 1897, 331.

Stems simple, 1–3 cm., lower part with small scale leaves, upper part densely clothed with normal leaves. Leaves when moist set at right angles to the stem, usually with a somewhat glaucous appearance; when dry appressed to the stem so that the sterile

shoots appear clavate. Leaves narrow lingulate, often slightly curved and asymmetrical, incurved when dry. Margin wider than in the other species, strongly inflexed so that at first sight the margin appears entire. At the apex the inflexed margin makes the leaf almost cucullate. Leaf base sheathing 2×1.5 mm., usually colourless except for the brown nerve; lamina 6–7 mm. long \times 0.75 to 1 mm. wide. Lamellae numerous, usually about 80, up to 65μ high, of four to five rows of cells, margin crenulate due to projecting cells. Marginal cells $20 \times 15\mu$, outer wall strongly thickened up to 5μ thick, usually elongated at right angles to the axis of the leaf. Lower cells very variable from thickened quadrate or hexagonal to thin-walled rectangular, mainly 12μ across. Seta orange-red, long, up to 3.5 cm., by 0.5 mm. Calyptra conical, 8×2 mm., densely covered with orange-crimson hairs. Perichaetial leaves with a very much reduced lamina and usually without lamellae. Apex very variable, in some plants obtuse and jagged toothed, in others finely acute. Capsule ovate 5×2 mm., horizontal, peristome silky or dirty white, 1.5 mm.

The above description is a composite description based on a wide range of material from Eastern Australia. Text-figures 13 and 26 are from the type specimen in Hampe's herbarium now at the Natural History Museum, South Kensington. *D. longiseta* is common on recently disturbed soil in sclerophyll forest from Tasmania to Queensland. Easily recognized by its small size and lingulate leaves. In this latter respect the figures in Plate ix of Mueller's Australian Mosses are somewhat misleading.

In reducing Hampe's *D. appressa* and C. Mueller's *D. Victoriae* to synonyms, it may seem that I have lumped more than is justified. However, after examining almost a hundred collections of plants attributed to these species I find no justification for retaining them as separate species, as all intergradations exist between the three forms which can be regarded as the original species. Furthermore, characters which might perhaps be associated with one species may be found together with characters from another and several combinations of characters will often occur in the one tuft.

Examination of the type specimens of *D. longiseta* and *D. appressa*, now at Natural History Museum, South Kensington, and a comparison of these with part of the type gathering of *D. Victoriae* from the Melbourne Herbarium shows them to be somewhat distinct. *D. longiseta* with stems about 2 cm. long, seta about 3 cm. straight, the leaves thick and inrolled appearing almost terete when dry; *D. appressa* with stems about 2 cm. long almost clavate from the appressed leaves, seta about 2 cm., usually with a pronounced curve a few mm. behind the capsule; *D. Victoriae* a small plant usually with the leaves flatter and more curved. There are also minor differences in the cells of the lamellae. When a range of specimens is examined these distinctions break down and it is impossible to assign the majority of specimens to one or other of the forms just mentioned. C. Mueller separated his *D. Victoriae* from *D. longiseta* on its smaller size, etc., and its obtuse perichaetial leaves. A dissection of a plant from the type gathering, however, shows obtuse and acute perichaetial leaves on the same plant. He does not compare his plant with *D. appressa*, which it much more closely resembles. Hampe distinguishes *D. appressa* as follows: "*D. longiseta* proxima differt; caule clavato longiore, foliis brevioribus, sicca appressis, seta brevior, theca minore, angulata et peristomia sericeo-niveo." These characters, however, will not stand, and it seems clear that both *D. Victoriae* and *D. appressa* are forms of a fairly variable *D. longiseta*.

Other workers seem to have met similar difficulties in separating these three supposed species. Most Victorian material seems to have been labelled *D. Victoriae*, apparently for no other reason than that it came from Victoria. All the New South Wales and Queensland material has been called *D. longiseta*. In herb. Dixon there is a good range of *D. longiseta* and alongside one packet from Fernshaw, Victoria, Dixon has written "much of this might well be *D. appressa*", yet some of the plants might equally well have been the original for F.v.M.'s figure of *D. longiseta* in his Australian Mosses.

Invalid Names.

In addition to the species described above, the following names appear either in the literature or in herbaria:

- D. altissima* C.M., herbarium MS. name only = *D. Beccarii* Broth. and Geh.
- D. crispata* Dix. Appears in Pflanzenfamilien, Ed. II, and is apparently an error for *D. crispifolia*. The same name appears in Lam's Fragmenta Papuana.
- D. insignis*. In the Handbuch der Pflanzenanatomie, Bd. VII/I, Anatomie der Laubmoose. Lorch refers (p. 65) to a *D. insignis*. I have been unable to find any other trace of such a species.
- D. Kinabaluensis* Broth. Brotherus' species was never published although distributed with specimens. On the appearance of Gepp's *D. brevifolia*, with which it is obviously conspecific, *D. Kinabaluensis* was dropped.
- D. longifolia* R. Brown. Appears on herbarium sheets at Kew and South Kensington. The specimens are clearly *D. superba*.
- D. longisetacea* appears as an error for *D. longisetata* in F. v. Mueller's Australian Mosses.
- D. Novae-Zelandiae* appears on a specimen at Kew, collected by Colenso near Auckland, New Zealand. It had subsequently been labelled *D. superba*, which it clearly is.

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